

United States Department of Agriculture Natural Resources Conservation Service

Ecological Site Description

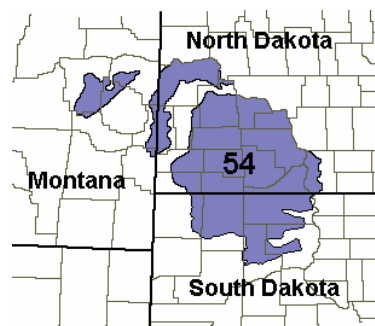
Site Name: Sandy Claypan

Site Type: Rangeland

Site ID: R054XY027ND

Major Land Resource Area: 54 – Rolling Soft Shale Plain

For more information on MLRA's refer to the following web site:
http://www.essc.psu.edu/soil_info/soil_lrr/



Physiographic Features

This site occurs on nearly level to rolling sedimentary uplands.

Landform: terrace, alluvial fan and hill

Aspect: NA

	<u>Minimum</u>	<u>Maximum</u>
Elevation (feet):	1600	3600
Slope (percent):	0	9
Water Table Depth (inches):	48	>72
Flooding:		
Frequency:	None	None
Duration:	None	None
Ponding:		
Depth (inches):	None	None
Frequency:	None	None
Duration:	None	None
Runoff Class:	Medium	High

Climatic Features

MLRA 54 is considered to have a continental climate – cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature are characteristic. The climate is the result of this MLRA's location in the geographic center of North America. There are few natural barriers on the northern Great Plains. The air masses move unobstructed across the plains and account for rapid changes in temperature.

Annual precipitation ranges from 14 to 18 inches per year. The normal average annual temperature is about 42° F. January is the coldest month with average temperatures ranging from about 13° F (Beach, ND) to about 16° F (Bison, SD). July is the warmest month with temperatures averaging from about 69° F (Beach, ND) to about 72° F (Timber Lake, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 57° F. This large annual range attests to the continental nature of this MLRA's climate. Hourly winds are estimated to average about 11 miles per hour annually, ranging from about 13 miles per hour during the spring to about 10 miles per hour during the summer. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 50 miles per hour.

Growth of native cool-season plants begins in late March and continues to early to mid July. Native warm-season plants begin growth in mid May and continue to the end of August. Green up of cool-season plants can occur in September and October when adequate soil moisture is present.

	<u>Minimum</u>	<u>Maximum</u>
Frost-free period (days):	119	136
Freeze-free period (days):	139	157
Mean Annual Precipitation (inches):	14	18

Average Monthly Precipitation (inches) and Temperature (°F):

	Precip. Min.	Precip. Max	Temp. Min.	Temp. Max.
January	0.41	0.54	2.2	23.8
February	0.37	0.61	8.7	30.4
March	0.51	1.07	17.1	40.0
April	1.13	1.88	28.9	56.8
May	1.98	2.83	40.5	69.3
June	2.83	3.29	49.8	78.3
July	2.05	2.25	54.6	85.2
August	1.49	2.07	53.0	84.3
September	1.29	1.45	42.0	73.4
October	0.89	1.35	31.6	60.4
November	0.48	0.61	19.0	41.5
December	0.42	0.55	8.1	29.0

Climate Stations		Period	
Station ID	Location or Name	From	To
ND0590	Beach	1949	1999
MT7560	Sidney	1949	1999
SD8307	Timber Lake	1948	1999
ND2183	Dickinson FAA AP	1948	1999

For local climate stations that may be more representative, refer to <http://www.wcc.nrcs.usda.gov>.

Influencing Water Features

No significant water features influence this site.

Representative Soil Features

The common features of soils in this site are the sandy loam to fine sandy loam textured subsoils and slopes of 0 to 9 percent. The soils in this site are moderately well to well drained and formed in soft sandstone or alluvium. The loamy fine sand to fine sandy loam surface layer is 5 to 13 inches thick. The soils have a moderate infiltration rate. This site should show slight to no evidence of rills, wind scoured areas or pedestalled plants. Water flow paths are broken, irregular in appearance or discontinuous with numerous debris dams or vegetative barriers. The soil surface is stable and intact. Sub-surface soil layers are restrictive to water movement and root penetration.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 6 percent. Loss of the soil surface layer can result in a shift in species composition and/or production.

Major soil series correlated to this ecological site can be found in Section II of the Natural Resources Conservation Service Field Office Technical Guide or the following web sites:

North Dakota <http://www.nd.nrcs.usda.gov/>

South Dakota <http://www.sd.nrcs.usda.gov/>

Montana <http://www.mt.nrcs.usda.gov/>

Parent Material Kind: alluvium and residuum

Parent Material Origin: sandstone, calcareous

Surface Texture: fine sandy loam, loamy fine sand, sandy loam

Surface Texture Modifier: none

Subsurface Texture Group: loamy

Surface Fragments $\leq 3''$ (% Cover): 0

Surface Fragments $> 3''$ (%Cover): 0

Subsurface Fragments $\leq 3''$ (% Volume): 0-10

Subsurface Fragments $> 3''$ (% Volume): 0-5

	<u>Minimum</u>	<u>Maximum</u>
Drainage Class:	moderately well	well
Permeability Class:	slow	moderately slow
Depth to first restrictive layer (inches):	6	20
Electrical Conductivity (mmhos/cm)*:	8	12
Sodium Absorption Ratio*:	4	25
Soil Reaction (1:1 Water)*:	6.1	9.0
Soil Reaction (0.1M CaCl₂)*:	NA	NA
Available Water Capacity (inches)*:	2	5
Calcium Carbonate Equivalent (percent)*:	0	10

* - These attributes represent from 0-40 inches or to the first restrictive layer.

Plant Communities

Ecological Dynamics of the Site:

The site developed under Northern Great Plains climatic conditions, and included natural influence of large herbivores and occasional fire. Changes will occur in the plant communities due to climatic conditions and/or management actions. Due to the nature of the soils, the site is considered quite fragile. Under continued adverse impacts, a rapid decline in vegetative vigor and composition will occur. Under favorable vegetative management treatments the site can slowly return to the Historic Climax Plant Community (HCPC).

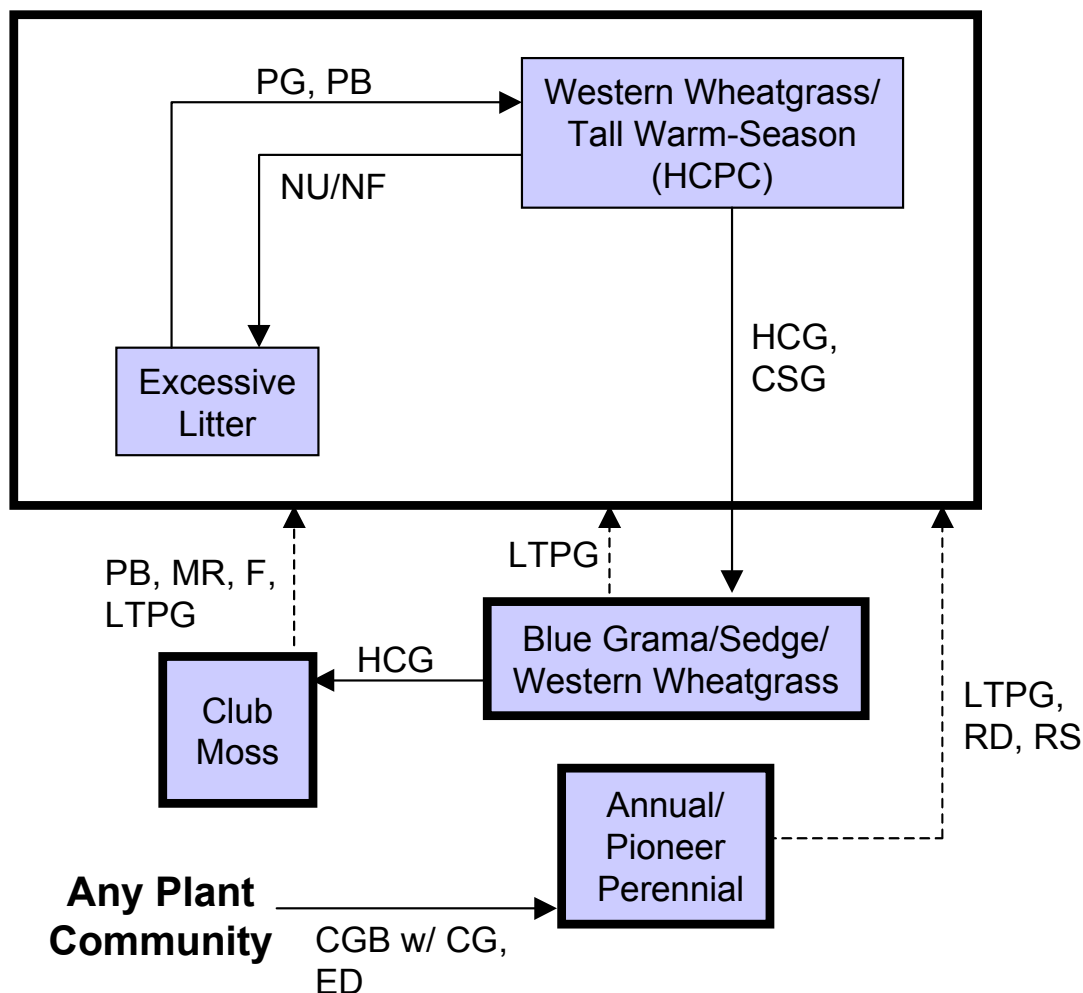
The plant community upon which interpretations are primarily based is the HCPC. The HCPC has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily grazed to lightly grazed areas, seasonal use pastures, and historical accounts also have been used. Subclimax plant communities, states, transitional pathways, and thresholds have been determined through similar studies and experience.

Continuous grazing without adequate recovery periods following each grazing occurrence over several years causes this site to depart from the HCPC. Species such as western wheatgrass, blue grama, sedges, cudweed sagewort, hairy golden aster, prairie coneflower, scurfpea and fringed sagewort will initially increase. Prairie sandreed, sand bluestem green needlegrass, false gromwell, vetch, penstemon and leadplant will decrease in frequency and production. In time, heavy continuous grazing will likely cause upland sedges and blue grama to dominate and pioneer perennials, annuals, and club moss (in its range) to increase. This plant community is relatively stable and the competitive advantage prevents other species from establishing. This plant community is less productive than the HCPC. Runoff increases and infiltration will decrease. Soil erosion will be minimal.

Extended periods of non-use and/or lack of fire will result in a plant community having high litter levels, which favors an increase in Kentucky bluegrass and/or smooth brome grass, and in time, shrubs such as western snowberry and silver sagebrush will increase.

The following is a diagram that illustrates the common plant communities that can occur on the site and the transition pathways between communities. The ecological processes will be discussed in more detail in the plant community descriptions following the diagram.

Plant Communities and Transitional Pathways



CGB w/ CG - cropped go-back with continuous grazing; **CSG** - continuous seasonal grazing; **ED** - excessive defoliation; **F** - fertilization followed with prescribed grazing; **HCPC** - Historical Climax Plant Community; **HCG** - heavy continuous grazing; **LTPG** - long-term prescribed grazing; **MR** - mechanical renovation with prescribed grazing; **NU/NF** - extended period of non-use & no fire; **PB** - prescribed burning; **PG** - prescribed grazing; **RD** - removal of disturbance; **RS** - range seeding with prescribed grazing.

Plant Community Composition and Group Annual Production

		Western Wheatgrass/Tall Warm-Season (HCPC)			
COMMON/GROUP NAME	SYMBOL	Group	lbs./acre	% Comp	
GRASSES & GRASS-LIKES			1400 - 1600	70 - 80	
western wheatgrass	PASM	1	300 - 500	15 - 25	
TALL WARM-SEASON GRASSES		2	200 - 300	10 - 15	
prairie sandreed	CALO	2	100 - 200	5 - 10	
sand bluestem	ANHA	2	60 - 140	3 - 7	
big bluestem	ANGE	2	0 - 60	0 - 3	
NEEDLEGRASS		3	200 - 300	10 - 15	
needleandthread	HECOC8	3	200 - 300	10 - 15	
green needlegrass	NAVI4	3	40 - 100	2 - 5	
GRAMA		4	100 - 200	5 - 10	
blue grama	BOGR2	4	100 - 200	5 - 10	
OTHER NATVE GRASSES		5	100 - 180	5 - 9	
little bluestem	SCSC	5	0 - 60	0 - 3	
sand dropseed	SPCR	5	0 - 20	0 - 1	
Scribner panicum	DIOLS	5	0 - 20	0 - 1	
prairie junegrass	KOMA	5	20 - 40	1 - 2	
Sandberg bluegrass	POSE	5	20 - 40	1 - 2	
Canada wildrye	ELCA4	5	0 - 20	0 - 1	
red threeawn	ARPUL	5	40 - 60	2 - 3	
other perennial grasses	2GP	5	20 - 40	1 - 2	
GRASS-LIKES		6	100 - 200	5 - 10	
threadleaf sedge	CAFI	6	100 - 180	5 - 8	
sun sedge	CAINH2	6	40 - 100	2 - 5	
other grass-likes	2GL	6	0 - 20	0 - 1	
FORBS		7	100 - 200	5 - 10	
American vetch	VIAM	7	0 - 20	0 - 1	
blanketflower	GAAR	7	0 - 20	0 - 1	
bracted spiderwort	TRBR	7	0 - 20	0 - 1	
cinquefoil	POTEN	7	0 - 20	0 - 1	
cudweed sagewort	ARLU	7	0 - 20	0 - 1	
false gromwell	ONMO	7	20 - 40	1 - 2	
gayfeather	LIATR	7	0 - 20	0 - 1	
goldenrod	SOLID	7	0 - 20	0 - 1	
green sagewort	ARDR4	7	0 - 20	0 - 1	
groundplum milkvetch	ASCR2	7	0 - 20	0 - 1	
hairy goldaster	HEVI4	7	0 - 20	0 - 1	
heath aster	SYER	7	0 - 20	0 - 1	
Hood's phlox	PHHO	7	0 - 20	0 - 1	
Lambert crazyweed	OXLA3	7	0 - 20	0 - 1	
penstemon	PENST	7	0 - 20	0 - 1	
prairie clover	DALEA	7	0 - 20	0 - 1	
prairie coneflower	RACO3	7	0 - 20	0 - 1	
purple coneflower	ECAN2	7	0 - 20	0 - 1	
rush skeletonweed	LYJU	7	0 - 20	0 - 1	
scarlet gaura	GACO5	7	0 - 20	0 - 1	
scarlet globemallow	SPCO	7	0 - 20	0 - 1	
scurfpea	PSORA2	7	20 - 40	1 - 2	
stiff sunflower	HEPA19	7	20 - 40	1 - 2	
wavyleaf thistle	CIUN	7	0 - 20	0 - 1	
western wallflower	ERCAC	7	0 - 20	0 - 1	
western yarrow	ACMI2	7	20 - 20	1 - 1	
other perennial forbs	2FP	7	0 - 20	0 - 1	
SHRUBS		8	20 - 100	1 - 5	
rose	ROSA5	8	20 - 40	1 - 2	
leadplant	AMCA8	8	20 - 40	1 - 2	
broom snakeweed	GUSA2	8	0 - 20	0 - 1	
fringed sagewort	ARFR4	8	20 - 40	1 - 2	
cactus	OPUNT	8	0 - 20	0 - 1	
western snowberry	SYOC	8	20 - 40	1 - 2	
silver sagebrush	ARCA13	8	20 - 40	1 - 2	
other shrubs	2SHRUB	8	0 - 40	0 - 2	
CRYPTOGAMS		9	0 - 20	0 - 1	
clubmoss	SEDE2	9	0 - 20	0 - 1	
Annual Production lbs./acre			LOW	RV	HIGH
GRASSES & GRASS-LIKES			1280	1780	2265
FORBS			95	150	205
SHRUBS			15	60	105
CRYPTOGAMS			0	10	25
TOTAL			1400	2000	2600

This list of plants and their relative proportions are based on near normal years. Fluctuations in species composition and relative production may change from year to year dependent upon precipitation or other climatic factors. RV = Representative Value.

Plant Community Composition and Group Annual Production

COMMON/GROUP NAME	SYMBOL	Western Wheatgrass/Tall Warm-Season (HCPC)			Blue Grama/Sedge/Western Wheatgrass			Excessive Litter			Club Moss		
		Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp	Grp	lbs./acre	% Comp
GRASSES & GRASS-LIKES			1400 - 1600	70 - 80		560 - 640	70 - 80		1190 - 1360	70 - 80		360 - 420	60 - 70
western wheatgrass	PASM	1	300 - 500	15 - 25	1	80 - 120	10 - 15	1	85 - 170	5 - 10	1	30 - 60	5 - 10
TALL WARM-SEASON GRASSES		2	200 - 300	10 - 15	2	16 - 40	2 - 5	2	51 - 85	3 - 5	2		
prairie sandreed	CALO	2	100 - 200	5 - 10	2	16 - 40	2 - 5	2	51 - 85	3 - 5			
sand bluestem	ANHA	2	20 - 100	1 - 5				2	0 - 17	0 - 1			
big bluestem	ANGE	2	0 - 60	0 - 3				2	0 - 17	0 - 1			
NEEDLEGRASS		3	200 - 300	10 - 15	3	32 - 40	4 - 5	3	85 - 170	5 - 10	3	12 - 24	2 - 4
needleandthread	HECOC8	3	200 - 300	10 - 15	3	32 - 40	4 - 5	3	85 - 170	5 - 10	3	12 - 24	2 - 4
green needlegrass	NAVI4	3	40 - 100	2 - 5	3	0 - 8	0 - 1	3	34 - 85	2 - 5			
GRAMA		4	100 - 200	5 - 10	4	240 - 280	30 - 35	4	17 - 68	1 - 4	4	150 - 180	25 - 30
blue grama	BOGR2	4	100 - 200	5 - 10	4	240 - 280	30 - 35	4	17 - 68	1 - 4	4	150 - 180	25 - 30
OTHER NATIVE GRASSES		5	100 - 180	5 - 9	5	32 - 64	4 - 8	5	85 - 170	5 - 10	5	24 - 48	4 - 8
little bluestem	SCSC	5	0 - 60	0 - 3	5	0 - 16	0 - 2	5	17 - 34	1 - 2			
sand dropseed	SPCR	5	0 - 20	0 - 1	5	8 - 24	1 - 3	5	17 - 51	1 - 3	5	6 - 12	1 - 2
Scribner panicum	DIOIS	5	0 - 20	0 - 1	5	8 - 24	1 - 3	5	0 - 17	0 - 1	5	6 - 12	1 - 2
prairie junegrass	KOMA	5	20 - 40	1 - 2	5	8 - 40	1 - 5	5	34 - 51	2 - 3	5	6 - 12	1 - 2
Sandberg bluegrass	POSE	5	20 - 40	1 - 2	5	24 - 40	3 - 5	5	85 - 170	5 - 10	5	18 - 30	3 - 5
Canada wildrye	ELCA4	5	0 - 20	0 - 1									
red threeawn	ARPUL	5	40 - 60	2 - 3	5	16 - 40	2 - 5	5	17 - 34	1 - 2	5	6 - 18	1 - 3
other perennial grasses	2GP	5	20 - 40	1 - 2	5	0 - 16	0 - 2	5	0 - 17	0 - 1	5	0 - 6	0 - 1
GRASS-LIKES		6	100 - 200	5 - 10	6	40 - 80	5 - 10	6	68 - 170	4 - 10	6	24 - 48	4 - 8
threadleaf sedge	CAFI	6	100 - 160	5 - 8	6	40 - 80	5 - 10	6	51 - 136	3 - 8	6	24 - 48	4 - 8
sun sedge	CAINH2	6	40 - 100	2 - 5	6	16 - 40	2 - 5	6	34 - 85	2 - 5	6	0 - 6	0 - 1
other grass-like	2GL	6	0 - 20	0 - 1	6	0 - 8	0 - 1	6	0 - 17	0 - 1	6	0 - 6	0 - 1
NON-NATIVE GRASSES		7			7			7	340 - 510	20 - 30	7	0 - 6	0 - 1
Kentucky bluegrass	POPR							7	170 - 510	10 - 30			
smooth brome	BRIN2							7	0 - 510	0 - 30			
crested wheatgrass	AGCR							7	0 - 340	0 - 20			
cheatgrass	BRT							7	0 - 170	0 - 10	7	0 - 6	0 - 1
FORBS		8	100 - 200	5 - 10	8	40 - 80	5 - 10	8	85 - 170	5 - 10	8	60 - 90	10 - 15
American vetch	VIAM	8	0 - 20	0 - 1				8	0 - 17	0 - 1			
blanketflower	GAAR	8	0 - 20	0 - 1	8	0 - 16	0 - 2	8	0 - 17	0 - 1	8	0 - 6	0 - 1
bracted spiderwort	TRBR	8	0 - 20	0 - 1				8	0 - 17	0 - 1			
cinquefoil	POTEN	8	0 - 20	0 - 1				8	0 - 17	0 - 1			
cudweed sage	ARLU	8	0 - 20	0 - 1	8	8 - 24	1 - 3	8	51 - 85	3 - 5	8	6 - 18	1 - 3
curlycup gumweed	GRSQ				8	8 - 24	1 - 3	8	0 - 17	0 - 1	8	12 - 24	2 - 4
deervetch	LOUNU				8	8 - 16	1 - 2	8	17 - 34	1 - 2	8	12 - 18	2 - 3
false gromwell	ONMO	8	20 - 40	1 - 2				8	0 - 17	0 - 1			
gayfeather	LIATR	8	0 - 20	0 - 1				8	0 - 17	0 - 1			
goldenrod	SOLID	8	0 - 20	0 - 1				8	17 - 34	1 - 2			
green sagewort	ARDR4	8	0 - 20	0 - 1				8	0 - 51	0 - 3			
groundplum milkvetch	ASCR2	8	0 - 20	0 - 1				8	0 - 17	0 - 1			
hairy goldaster	HEVI4	8	0 - 20	0 - 1	8	24 - 40	3 - 5	8	0 - 17	0 - 1	8	24 - 48	4 - 8
heath aster	SYER	8	0 - 20	0 - 1	8	24 - 40	3 - 5	8	34 - 51	2 - 3	8	24 - 48	4 - 8
Hood's phlox	PHHO	8	0 - 20	0 - 1	8	8 - 16	1 - 2	8	0 - 17	0 - 1	8	6 - 12	1 - 2
Lambert crazyweed	OXLA3	8	0 - 20	0 - 1	8	16 - 40	2 - 5	8	0 - 17	0 - 1	8	12 - 30	2 - 5
penstemon	PENST	8	0 - 20	0 - 1				8	0 - 17	0 - 1			
prairie clover	DALEA	8	0 - 20	0 - 1				8	0 - 17	0 - 1			
prairie coneflower	RACO3	8	0 - 20	0 - 1	8	24 - 40	3 - 5	8	17 - 34	1 - 2	8	24 - 48	4 - 8
purple coneflower	ECAN2	8	0 - 20	0 - 1	8	0 - 8	0 - 1	8	0 - 17	0 - 1			
rush skeletonweed	LYJU	8	0 - 20	0 - 1	8	8 - 16	1 - 2	8	0 - 17	0 - 1	8	6 - 12	1 - 2
scarlet gaura	GACO5	8	0 - 20	0 - 1				8	0 - 17	0 - 1			
scarlet globemallow	SPCO	8	0 - 20	0 - 1	8	8 - 24	1 - 3	8	0 - 17	0 - 1	8	6 - 18	1 - 3
scurpea	PSORA2	8	20 - 40	1 - 2	8	24 - 64	3 - 8	8	34 - 51	2 - 3	8	24 - 48	4 - 8
stiff sunflower	HEPA19	8	20 - 40	1 - 2				8	17 - 34	1 - 2			
wavyleaf thistle	CIUN	8	0 - 20	0 - 1	8	8 - 24	1 - 3	8	17 - 34	1 - 2	8	12 - 24	2 - 4
western salsify	TRDU				8	8 - 8	1 - 1	8	17 - 34	1 - 2	8	6 - 12	1 - 2
western wallflower	ERCAC	8	0 - 20	0 - 1	8	8 - 24	1 - 3	8	17 - 34	1 - 2	8	6 - 12	1 - 2
western yarrow	ACMI2	8	20 - 20	1 - 1	8	16 - 40	2 - 5	8	17 - 34	1 - 2	8	6 - 12	1 - 2
woolly Indianwheat	PLPA2				8	8 - 16	1 - 2	8	0 - 17	0 - 1	8	12 - 18	2 - 3
other perennial forbs	2FP	8	0 - 20	0 - 1	8	0 - 16	0 - 2	8	0 - 34	0 - 2	8	0 - 12	0 - 2
non-native forbs	2FORB				8	0 - 64	0 - 8	8	0 - 255	0 - 15	8	0 - 24	0 - 4
SHRUBS		9	20 - 100	1 - 5	9	32 - 80	4 - 10	9	85 - 170	5 - 10	9	24 - 84	4 - 14
rose	ROSA5	9	20 - 40	1 - 2	9	8 - 16	1 - 2	9	17 - 51	1 - 3	9	0 - 6	0 - 1
leadplant	AMCA6	9	20 - 40	1 - 2				9	0 - 34	0 - 2			
broom snakeweed	GUSA2	9	0 - 20	0 - 1	9	16 - 24	2 - 3	9	0 - 17	0 - 1	9	18 - 24	3 - 4
fringed sagewort	ARFR4	9	20 - 40	1 - 2	9	32 - 64	4 - 8	9	34 - 68	2 - 4	9	30 - 60	5 - 10
cactus	OPUNT	9	0 - 20	0 - 1	9	8 - 24	1 - 3	9	17 - 34	1 - 2	9	12 - 18	2 - 3
western snowberry	SYOC	9	20 - 40	1 - 2	9	0 - 8	0 - 1	9	34 - 119	2 - 7			
silver sagebrush	ARCA13	9	20 - 40	1 - 2	9	0 - 32	0 - 4	9	34 - 119	2 - 7	9	0 - 12	0 - 2
other shrubs	2SHRUB	9	0 - 40	0 - 2	9	0 - 8	0 - 1	9	0 - 34	0 - 2	9	0 - 6	0 - 1
CRYPTOGAMS		10	0 - 20	0 - 1	10	8 - 16	1 - 2	10	0 - 17	0 - 1	10	30 - 60	5 - 10
clubmoss	SEDE2	10	0 - 20	0 - 1	10	8 - 16	1 - 2	10	0 - 17	0 - 1	10	30 - 60	5 - 10
Annual Production lbs./acre			LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		LOW RV HIGH		
GRASSES & GRASS-LIKES			1290 - 1780 - 2265		330 - 672 - 710		940 - 1437 - 1930		100 - 426 - 455				
FORBS			95 - 150 - 205		35 - 60 - 85		80 - 128 - 175		55 - 75 - 95				
SHRUBS			15 - 60 - 105		30 - 56 - 85		80 - 128 - 175		20 - 54 - 85				
CRYPTOGAMS			0 - 10 - 25		5 - 12 - 20		0 - 9 - 20		25 - 45 - 65				
TOTAL			1400 - 2000 - 2600		400 - 800 - 900		1100 - 1700 - 2300		200 - 600 - 700				

This list of plants and their relative proportions are based on near normal years. Fluctuations in species composition and relative production may change from year to year dependent upon precipitation or other climatic factors. RV = Representative value.

Plant Community and Vegetation State Narratives

Following are the narratives for each of the described plant communities. These plant communities may not represent every possibility, but they are the most prevalent and repeatable plant communities. The plant composition tables shown above have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these plant communities may be revised or removed, and new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities”. According to the USDA NRCS National Range and Pasture Handbook, Desired Plant Communities (DPC’s) will be determined by the decision makers and will meet minimum quality criteria established by the NRCS. The main purpose for including any description of a plant community here is to capture the current knowledge and experience at the time of this revision.

Western Wheatgrass/Tall Warm-Season Plant Community

This is the interpretive plant community and is considered to be the Historic Climax Plant Community (HCPC). This community evolved with grazing by large herbivores and occasional prairie fire. It is well suited for grazing by domestic livestock and can be found on areas that are properly managed with prescribed grazing that allows for proper utilization, changes in season of use and adequate recovery periods following each grazing event.

The potential vegetation is about 82% grasses or grass-like plants, 10% forbs, and 8% shrubs. Cool-season and tall warm-season grasses dominate the plant community. The co-dominant grasses include western wheatgrass and prairie sandreed. Other grasses and grass-like plants occurring on the site include needleandthread, green needlegrass, blue grama, prairie junegrass and sedges. Significant forbs include stiff sunflower, false gromwell, silverleaf scurfpea, western yarrow and goldenrod. In many areas western snowberry is the principle shrub and occurs in patchy mosaic. In other areas, silver sagebrush is the dominant shrub and occurs more evenly dispersed across the site. Other shrubs include prairie rose, leadplant and fringed sagewort.

This plant community is well adapted to the Northern Great Plains climatic conditions. Individual species can vary greatly in production depending on growing conditions (timing and amount of precipitation and temperature). Community dynamics, nutrient cycle, water cycle and energy flow are functioning properly. Plant litter is properly distributed with very little movement off-site and natural plant mortality is very low. The diversity in plant species allows for high drought tolerance. Low available water capacity coupled with high accumulations of sodium and slow permeability strongly influences the soil-water-plant relationship.

The following growth curve is an estimate of the monthly percentages of the annual growth of the dormant species expected during the normal year.

Growth curve number: ND5402

Growth curve name: Missouri Slope, Native Grasslands, Cool/Warm-season Mix.

Growth curve description: Cool-season/tall warm-season dominant.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	2	6	21	40	20	6	4	1	0	0

Transitional pathways and/or community pathways leading to other plant communities are as follows:

- Non-use and no fire for extended periods of time will convert this plant community to the *Excessive Litter Plant Community*.
- Heavy, continuous grazing or continuous seasonal grazing will convert the plant community to the *Blue Grama/Sedge/Western Wheatgrass Plant Community*.

- Excessive defoliation (i.e., areas of heavy animal concentration) will convert the plant community to the *Annual/Pioneer Perennial Plant Community*.
- Go-back land with continuous grazing will convert this plant community to the *Annual/Pioneer Perennial Plant Community* or the *Club Moss Plant Community*.

Blue Grama/Sedge/Western Wheatgrass Plant Community

This plant community can quickly develop from the adverse effects of heavy, continuous grazing and/or annual, early spring seasonal grazing. Annual grazing too early in the spring depletes stored carbohydrates, resulting in weakening and eventual death of the cool season mid-grasses. Short grasses and grass-like and forbs increase to dominate the site and annual production decreases dramatically. Lack of litter and reduced plant vigor result in higher soil temperatures, poor water infiltration rates, and high evapotranspiration, which gives blue grama and sedges a competitive advantage over cool season mid-grasses. This plant community can occur throughout the pasture, on spot grazed areas, and around water sources where season-long grazing patterns occur.

Blue grama, sedges and western wheatgrass are the dominant species. Other grasses that may be present include Sandberg bluegrass, red threeawn, needleandthread, prairie junegrass and annual grasses. Forbs such as hairy goldaster, cudweed sagewort, heath aster, Lambert crazyweed, prairie coneflower, scurfspea and western yarrow may also be present. There is usually less than 10% bare ground.

This plant community is relatively stable. The thick sod and competitive advantage prevents other species from establishing. This plant community is less productive than the HCPC. Runoff increases and infiltration will decrease. Soil erosion will be minimal due to the sod forming habit of blue grama.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during a normal year:

Growth curve number: ND5404

Growth curve name: Missouri Slope, Warm-season Dominant, Cool-season Subdominant.

Growth curve description: Short warm-season dominant, mid cool-season subdominant & club moss.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	1	5	20	38	25	8	3	0	0	0

Transitional pathways and/or community pathways leading to other plant communities are as follows:

- Long-term prescribed grazing that includes changing season of use and allowing adequate recovery periods to enhance cool season grasses will lead this plant community back to the *Western Wheatgrass/Tall Warm-Season Plant Community*.
- Heavy, continuous grazing may cause further deterioration resulting in a shift to the *Club Moss Plant Community*.
- Excessive defoliation (i.e., areas of heavy animal concentration,) will convert the plant community to the *Annual/Pioneer Perennial Plant Community*.
- Cropped go-back land with continuous grazing will convert this plant community to the *Annual/Pioneer Perennial Plant Community*.

Excessive Litter Plant Community

This plant community develops after an extended period of 15 or more years of non-use by herbivores and exclusion of fire. This plant community is dispersed throughout the pasture, encircling spot grazed areas, and areas distant from water sources. This is a typical pattern found in properly stocked pastures grazed season-long. Plant litter accumulates in large amounts as this community develops. Litter buildup reduces plant vigor and density, and seedling recruitment declines. Eventually litter levels become abundant enough to crowd out living plants and reduce plant density. Annual and/or biennial forbs, annual grasses, and cryptogams commonly fill these interspaces.

Due to a lack of tiller stimulation and sunlight, native bunchgrasses typically develop dead centers and native rhizomatous grasses are limited to small colonies. Heavy litter covers shorter understory species (i.e. short grasses and sedges) restricting their ability to capture adequate sunlight for photosynthesis. Vigor and diversity of native plants are reduced.

Non-native grasses, such as Kentucky bluegrass, crested wheatgrass, smooth brome grass and cheatgrass tend to dominate this plant community. Other grasses that may be present include western wheatgrass, needleandthread, green needlegrass and Sandberg bluegrass. The common forbs include sweetclover, green sagewort, cudweed sagewort and heath aster. Fringed sagewort, snowberry and/or silver sagebrush are the principal shrubs and tend to increase in density and cover.

This plant community is resistant to change without prescribed grazing or fire. The combination of both grazing and fire is most effective in moving this plant community towards the HCPC. Soil erosion is low. Compared to the HCPC, infiltration is reduced to the lower root zone. Runoff is similar to the HCPC. This plant community tends to be moisture loving and usually tends to utilize the spring moisture quickly causing forage base to become dry and not very palatable early in the summer. Once this plant community is reached, time and external resources will be needed to see any immediate recovery in the diversity of the site.

The following growth curve is an estimate of the monthly percentages of total annual growth of the dominant species expected during a normal year:

Growth curve number: ND5406

Growth curve name: Missouri Slope, Introduced Cool-season Grasses.

Growth curve description: Introduced cool-season grasses.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	3	10	35	35	5	2	8	2	0	0

Transitional pathways and/or community pathways leading to other plant communities are as follows:

- With prescribed grazing and/or prescribed burning, this plant community will move toward the *Western Wheatgrass/Tall Warm-Season Plant Community*. This would require long-term management with prescribed grazing and/or prescribed burning under controlled conditions.

Club Moss Plant Community

This plant community typically occurs in the western portion of MLRA 54. A dense sod of club moss dominates this plant community. Club moss occupies bare soil areas within deteriorated or disturbed higher successional plant communities due to long-term repeated disturbances. Club moss cover is often 25% or greater. Club moss creates a more arid microclimate, resulting in extreme competition for available moisture. Initial runoff rates are low but then increase as clubmoss becomes saturated. Once clubmoss has been saturated then runoff increases and infiltration decreases as compared HCPC. Vigor and production of other species are reduced dramatically.

Grasses and grass-like plants include western wheatgrass, blue grama, Sandberg bluegrass and upland sedges. Forbs commonly found in this plant community include cudweed sagewort, hairy goldenaster, heath aster, prairie coneflower, scurfpea, annual deervetch and western yarrow. When compared to the Western Wheatgrass/Tall Warm-Season Plant Community, blue grama and club moss have increased, while western wheatgrass has decreased and the tall warm-season grasses have disappeared.

The following growth curve represents monthly percentages of total annual growth of the dominant species during a normal year:

Growth curve number: ND5404

Growth curve name: Missouri Slope, Warm-season Dominant, Cool-season Subdominant.

Growth curve description: Short warm-season dominant, mid cool-season subdominant & club moss.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	0	1	5	20	38	25	8	3	0	0	0

Transitional pathways and/or community pathways leading to other plant communities are as follows:

- Fertilization combined with prescribed grazing will move this plant community subsequently through the successional stages leading toward the *Western Wheatgrass/Tall Warm-Season Plant Community*.
- Mechanical renovation followed by prescribed grazing will reduce club moss, increase western wheatgrass, and eventually shift this plant community back toward the *Western Wheatgrass/Tall Warm-Season Plant Community*.
- Prescribed burning followed by prescribed grazing may eventually convert this plant community back to the *Western Wheatgrass/Tall Warm-Season Plant Community*.
- Long-term prescribed grazing may eventually moves this plant community through the successional stages leading toward the *Western Wheatgrass/Tall Warm-Season Plant Community*.
- Excessive defoliation (i.e., areas of heavy animal concentration,) will convert the plant community to the *Annual/Pioneer Perennial Plant Community*.
- Cropped go-back land with continuous grazing will convert this plant community to the *Annual/Pioneer Perennial Plant Community*.

Annual/Pioneer Perennial Plant Community

This plant community develops under severe disturbance and/or excessive defoliation. This can result from heavy livestock or wildlife concentration, and cropping abandonment (go-back land). The dominant vegetation includes pioneer annual grasses, forbs, invaders, and early successional biennial and perennial species. Grasses may include red threeawn, smooth brome, crested wheatgrass, annual brome, needleandthread, prairie junegrass and western wheatgrass. The dominant forbs include curlycup gumweed, maretail, salsify, kochia, field bindweed, thistles, western ragweed, pussytoes, prostrate verbena and other early successional species. Shrubs that may be present include prairie rose, fringed sagewort and broom snakeweed. Plant species from adjacent ecological sites may become minor components of this plant community. The community also is susceptible to invasion of non-native species due to severe soil disturbances and relatively high percent of bare ground. Many annual and perennial forbs, including non-native species, have invaded the site.

This plant community is resistant to change, as long as soil disturbance or severe vegetation defoliation persist, thus holding back secondary plant succession. Soil erosion is potentially high in this vegetation state. Reduced surface cover, low plant density, low plant vigor, loss of root biomass, and soil compaction, all contribute to decreased water infiltration, increased runoff, and accelerated erosion rates.

Significant economic inputs, management and time would be required to move this plant community toward a higher successional stage and a more productive plant community. Secondary succession is highly variable, depending upon availability and diversity of a viable seed bank of higher successional species within the existing plant community and neighboring plant communities. This plant community can be renovated to improve the production capability, but management changes would be needed to maintain the new plant community. The total annual production ranges from 300 to 1100 lbs./ac. (air-dry weight) depending upon growing conditions.

Transitional pathways and/or community pathways leading to other plant communities are as follows:

- Under long-term prescribed grazing and/or removal of disturbance, including adequate rest periods, this plant community will move through the successional stages, and may eventually lead to the *Western Wheatgrass/Tall Warm-Season Plant Community*. Depending on the slope, aspect, and size, and if adequate perennial plants exist, this change can occur more rapidly. This process will likely take a long period of time (50+ years).
- Range seeding with deferment and long term prescribed grazing can convert this to a plant community resembling the *Western Wheatgrass/Tall Warm-Season Plant Community*.

Ecological Site Interpretations

Animal Community – Wildlife Interpretations

-- Under Development --

Western Wheatgrass/Tall Warm-Season Plant Community:

Blue Grama/Sedge/Western Wheatgrass Plant Community:

Excessive Litter Plant Community:

Clubmoss Plant Community:

Annual/Pioneer Perennial Plant Community:

Animal Preferences (Quarterly – 1,2,3,4[†])

Common Name	Cattle	Sheep	Horses	Deer	Antelope	Bison	Elk
sses & Grass-like							
big bluestem	U D P D	U D U U	U D P D	U D U U	U D U U	U D P D	U D P D
blue grama	U D P U	D P P D	U D P U	D P P D	D P P D	U D P U	U D P U
Canada wildrye	U D U U	N U N N	U D U U	N U N N	N U N N	U D U U	U D U U
cheatgrass	U D U U	N P U N	U D U U	N P U N	N P U N	U D U U	U D U U
crested wheatgrass	U P U D	U P N N	U P U D	U P N N	U P N N	U P U D	U P U D
green needlegrass	U P U D	N P N P	U P U D	N P N P	N P N P	U P U D	U P U D
Kentucky bluegrass	U D U U	U P N D	U D U U	U P N D	U P N D	U D U U	U D U U
little bluestem	U D U D	N D N N	U D U U	N D N N	N D N N	U D U U	U D U U
needleandthread	U D U D	N D N U	U D U D	N D N U	N D N U	U D U D	U D U D
prairie junegrass	U D U D	N D N U	U D U D	N D N U	N D N U	U D U D	U D U D
prairie sandreed	U D D U	U D U U	U D D U	U U D U	U U D U	U D D U	U D D U
red threeawn	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N
sand bluestem	U D P D	U D U U	U D P D	U D U U	U D U U	U D P D	U D P D
sand dropseed	N U N N	N U N N	N U N N	N U N N	N U N N	N U N N	N U N N
Sandberg bluegrass	N U N N	N D N N	N U N N	N D N N	N D N N	N U N N	N U N N
Scribner panicum	U U D U	N U N N	U U D U	N U N N	N U N N	U U D U	U U D U
smooth brome	U P U U	U P U U	U P U U	U P U U	U P U U	U P U U	U P U U
sun sedge	U D U D	U P N D	U D U D	U D U D	U D U D	U D U D	U D U D
threadleaf sedge	U D U D	U P N D	U D U D	U D U D	U D U D	U D U D	U D U D
western wheatgrass	U P D U	N D N N	U P D U	N D N N	N D N N	U P D U	U P D U
bs							
American vetch	U D P U	U P P U	U D P U	U P P U	U P P U	U D P U	U P P U
blanketflower	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
bracted spiderwort	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N
cinquefoil	U U D U	U U U U	U U D U	U U U U	U U U U	U U D U	U U U U
cudweed	U U U U	U U D U	U U U U	U U D U	U U D U	U U U U	U U D U
false gromwell	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N
gayfeather	U U D U	U P P U	U U D U	U P P U	U P P U	U U D U	U P P U
goldenrod	U U D U	N U U N	U U D U	N U U N	N U U N	U U D U	N U U N
green sage	U U U U	U U U U	U U U U	U U U U	U U U U	U U U U	U U U U
groundplum milkvetch	U D U U	U D D U	U D U U	U D D U	U D D U	U D U U	U D D U
hairy goldaster	U U D U	N N N N	U U D U	N N N N	N N N N	U U D U	N N N N
heath aster	U U D U	U P U U	U U D U	U P U U	U P U U	U U D U	U P U U
Hood's phlox	U D U U	U P P U	U D U U	U P P U	U P P U	U D U U	U P P U
Lambert crazyweed	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T	T T T T
penstemon	U U U U	U P P U	U U U U	U P P U	U P P U	U U U U	U P P U
prairie clover	U D P U	U P P U	U D P U	U P P U	U P P U	U D P U	U P P U
prairie coneflower	U U D U	U P P U	U U D U	U P P U	U P P U	U U D U	U P P U
purple coneflower	U U D U	U P P U	U U D U	U P P U	U P P U	U U D U	U P P U
rush skeletonweed	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N
scarlet gaura	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
scarlet globemallow	U U D U	U D D U	U U D U	U D D U	U D D U	U U D U	U D D U
scurfpea	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
stiff sunflower	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U	U D P U
wavyleaf thistle	U U U U	N N N N	U U U U	N N N N	N N N N	U U U U	N N N N
western wallflower	U D U U	N U U N	U D U U	N U U N	N U U N	U D U U	N U U N
western yarrow	U U U U	N U U N	U U U U	N U U N	N U U N	U U U U	N U U N
ubs							
broom snakeweed	N N N N	U U U U	N N N N	U U U U	U U U U	N N N N	U U U U
cactus	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N
fringed sage	U U U U	U U U U	U U U U	U D D U	U P P D	U U U U	U U U D
leadplant	U P D U	U P D U	U P D U	U P D U	U P D U	U P D U	U P D U
rose	U D D U	U D D U	U D D U	U D D U	U D D U	U D D U	U D D U
silver sagebrush	D U U D	D U U D	D U U D	P D D P	P P P P	D U U D	D U U D
western snowberry	U U U U	U U U U	U U U U	D U D D	U U U U	U U U U	D U U U
yptogams							
clubmoss	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N	N N N N

N = not used; **U** = undesirable; **D** = desirable; **P** = preferred; **T** = toxic

[†] Quarters: 1 – Jan., Feb., Mar.; 2 – Apr., May, Jun.; 3 – Jul., Aug., Sep.; 4 – Oct., Nov., Dec.

Animal Community – Grazing Interpretations

The following table lists suggested initial stocking rates for cattle under continuous grazing (year long grazing or growing season long grazing) under normal growing conditions; however, *continuous grazing is not recommended*. These are conservative estimates that should be used only as guidelines in the initial stages of the conservation planning process and may need to be adjusted due to diet preferences of other types or kinds of livestock and/or other factors. Often, the current plant composition does not entirely match any particular plant community (as described in this ecological site description). Because of this, a field visit is recommended, in all cases, to document plant composition and production. More precise carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data, particularly when grazers other than cattle are involved. With consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity.

Plant Community	Production (lbs./acre)	Carrying Capacity ¹ (AUM/acre)
Western Wheatgrass/Tall Warm-Season (HCPC)	2000	0.63
Excessive Litter	1700	0.54 ²
Blue Grama/Sedge/Western Wheatgrass	800	0.25
Club Moss	600	0.19
Annual/Pioneer Perennial	-- ³	-- ³

¹ Continuous season-long grazing by cattle under average growing conditions.

² Stocking rates may need to be adjusted due to palatability and/or availability of forage.

³ Highly variable; stocking rate needs to be determined on site.

Hydrology Functions

Water is the principal factor limiting herbage production on this site. The site is dominated by soils in hydrologic group D. Infiltration varies from moderate to slow and runoff potential varies from medium to high depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75% ground cover have the greatest potential for high infiltration and lower runoff. An exception would be where short grasses form a dense sod and dominate the site. Areas where ground cover is less than 50% have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational Uses

This site provides hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Wood Products

No appreciable wood products are present on the site.

Other Products

Seed harvest of native plant species can provide additional income on this site.

Supporting Information

Associated Sites

- (054XY033ND) – Thin Claypan
- (054XY025ND) – Sands
- (054XY026ND) – Sandy

Similar Sites

(054XY021ND) – Claypan (Cp)

[Well drained soils on uplands or terraces that don't receive extra moisture with a dense sodic subsoil below 6 inches with salts below 16 inches. Indicator species are western wheatgrass with an understory of blue grama, heath aster, and western yarrow along with a few shrubs of fringed sagewort and Nuttall's Saltbush. This site has less production, no prairie sandreed and little threadleaf sedge, more blue grama and Sandberg's bluegrass, soil texture is finer but with similar sodic subsoils layer.]

(054XY026ND) – Sandy (Sy)

[Does not receive additional moisture. Found on dry uplands upslope from sandy terraces or loamy overflow sites, down slope from limy sands or shallow sandy sites. Similar landscape position as loamy, sands, clayey sites; will ribbon up to 1 inches. Indicator species are prairie sandreed with western wheatgrass and green needlegrass intermixed. This site doesn't have dense sodic subsoil below 6 inches with salts below 16 inches, far less western wheatgrass, blue grama, more prairie sandreed, and sand bluestem, more production.]

(054XY042ND) – Sandy Terrace (SyT)

[Well drained soils on a river or stream terrace in a position that will flood occasionally (once in ten years) with no apparent water table. Indicator species are prairie sandreed evenly mixed with sand bluestem, some Canada wildrye, penstemon, and leadplant and/or western snowberry, and with possible trees. This site doesn't have dense sodic subsoil below 6 inches with salts below 16 inches, far less western wheatgrass, blue grama, more prairie sandreed, and sand bluestem, with more silver sagebrush and/or western snowberry and sporadic trees, more production.]

(054XY025ND) – Sands (Sa)

[Does not receive additional moisture. Found on dry uplands, upslope from sandy terraces or loamy overflow sites, down slope from limy sands or shallow sandy sites. Similar landscape position as loamy, sandy, and clayey sites. Won't form a ribbon; indicator species are sand bluestem and prairie sandreed evenly mixed, some Canada wildrye, penstemon, and leadplant and western snowberry. This site doesn't have dense sodic subsoil below 6 inches with salts below 16 inches, far less western wheatgrass, blue grama, more prairie sandreed, and sand bluestem, more production.]

(054XY043ND) – Shallow Sandy (SwSy)

[Some what excessively drained soils more than 10 less than 20 inches to sedimentary sandstone bedrock and/or gravels that restricts root penetration. Surface layer will ribbon less than 1 inch unless above gravels than more than 1 but less than 2 inches. Upslope from thin loamy, limy sands, sands or sandy sites and some times down slope form very shallow ecological sites. Indicator species: little bluestem, prairie sandreed, sand bluestem, and needle grasses, with dotted gayfeather, pasqueflower, purple coneflower and purple prairie clover, and shrubs like prairie rose and yucca. This site has less production, a limiting layer above 20 inches without a dense sodic subsoil below 6 inches with salts below 16 inches more little bluestem, plains muhly, sideoats grama, less western wheatgrass, usually different landscape positions]

Inventory Data References

Information presented here has been derived from NRCS clipping and other inventory data. Also, field knowledge of range-trained personnel was used. All descriptions were peer reviewed and/or field tested by various private, State and Federal agency specialist.

Those involved in developing this site description include: Dennis Froemke, NRCS Range Management Specialist; Jeff Printz, NRCS State Range Management Specialist; L. Michael Stirling, NRCS Range Management Specialist; Stan Boltz, NRCS Range Management Specialist; Darrell Vanderbusch, NRCS Resource Soil Scientist; David Dewald, NRCS State Biologist; and Brad Podoll, NRCS Biologist.

<u>Data Source</u>	<u>Number of Records</u>	<u>Sample Period</u>	<u>State</u>	<u>County</u>
SCS-RANGE-417	4	1979 – 1982	ND	Grant
ND-Cons-20	4	1997 – 2001	ND	Bowman, Morton

State Correlation

This site has been correlated with Montana and South Dakota in MLRA 54.

Field Offices

Baker, MT	Buffalo, SD	Faith, SD	Mott, ND
Beach, ND	Carson, ND	Hettinger, ND	Selfridge, ND
Beulah, ND	Culbertson, MT	Killdeer, ND	Sidney, MT
Bison, SD	Dickinson, ND	Mandan, ND	Watford City, ND
Bowman, ND	Dupree, SD	McIntosh, SD	Wibaux, MT

Relationship to Other Established Classifications

Level IV Ecoregions of the Conterminous United States: 43a – Missouri Plateau.

Other References

High Plains Regional Climate Center, University of Nebraska, 830728 Chase Hall, Lincoln, NE 68583-0728. (<http://hpccsun.unl.edu>)

USDA, NRCS. National Water and Climate Center, 101 SW Main, Suite 1600, Portland, OR 97204-3224. (<http://wcc.nrcs.usda.gov>)

USDA, NRCS. National Range and Pasture Handbook, September 1997

USDA, NRCS. National Soil Information System, Information Technology Center, 2150 Centre Avenue, Building A, Fort Collins, CO 80526. (<http://nasis.nrcs.usda.gov>)

USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

USDA, NRCS, Various Published Soil Surveys.

Site Description Approval

_____ State Range Management Specialist	_____ Date	_____ State Range Management Specialist	_____ Date
--	---------------	--	---------------

_____ State Range Management Specialist	_____ Date
--	---------------